WHAT IS CLAIMED IS:

1. A method for measuring properties of a sample, comprising:

focusing a polarized sample beam of broadband radiation onto the sample, said beam having a multitude of polarization states;

collecting radiation modified by the sample;

analyzing and dispersing the radiation modified by and collected from the sample to provide a polarimetric spectrum; and

deriving film thickness and refractive index information of the sample from said spectrum.

2. The method of claim 1, further comprising splitting a beam of broadband radiation into said polarized sample beam and a reference beam; wherein said focusing focuses said sample beam onto the sample.

3. The method of claim 2, further comprising detecting the reference beam to provide a reference spectrum; and wherein said deriving includes comparing said polarimetric spectrum and said reference spectrum to obtain said film thickness and refractive index information of the sample.

4. The method of claim 3, said beam and said reflected and reference spectra including multiple wavelengths ranging from about 190 nm to about 830 nm.

5. The method of claim 2, said splitting including directing the beam to a mirror placed less than completely across said radiation beam.

6. The method of claim 2, said splitting including deflecting a portion of said beam into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

7. The method of claim 1, further comprising passing a beam of radiation through a polarizer, wherein said analyzing analyzes by means of an analyzer, and wherein during the focusing and analyzing steps, the polarizer and analyzer do not rotate.

8. The method of claim 1, further comprising polarizing a beam of broadband radiation to provide said polarized beam, wherein said focusing focuses said polarized beam such that a beam having a multitude of polarization states is focused onto the sample, wherein said polarization states are functions of an angle ϕ to a reference plane normal to a sample surface.

9. The method of claim 8, wherein said focusing focuses said polarized beam along different planes of incidence onto the sample, said planes being at different angles ϕ to the reference plane.

10. The method of claim 1, wherein said focusing and collecting employ a common objective.

11. The method of claim 1, said sample having one or more axes of birefringence, wherein said focusing or collecting employs an aperture centered about one of said axes.

12. The method of claim 11, wherein said focusing and collecting are repeated employing at least two different apertures aligned respectively about at least two of said axes.

13. The method of claim 12, wherein said focusing and collecting are repeated employing at least two different apertures centered respectively about at least two of said axes.

14. The method of claim 1, wherein said focusing and collecting are repeated employing two different apertures to detect presence or absence of an axis of birefringence in the sample.

15. The method of claim 1, said polarimetric spectrum including multiple wavelengths ranging from about 190 nm to about 830 nm.

16. The method of claim 1, wherein said analyzing analyzes the radiation modified by the sample with respect to a predetermined and fixed polarization plane.

17. The method of claim 1, further comprising altering phase of the radiation modified by and collected from the sample prior to analyzing and dispersing it.

18. The method of claim 17, wherein said altering retards said phase of the modified and collected radiation by about $\pi/4$.

19. An apparatus for measuring properties of a sample, comprising:

means for focusing a polarizer sample beam of broadband radiation onto the surface of the sample, the sample beam having a multitude of polarization states;

means for collecting radiation modified by the sample;

means for analyzing and dispersing the radiation modified by and collected from the sample to provide a polarimetric spectrum; and

means for deriving film thickness and refractive index information of the sample from said polarimetric spectrum.

20. The apparatus of claim 19, further comprising:

a radiation source providing a beam of broadband radiation; and

means for splitting said beam of broadband radiation into said polarized sample beam and a reference beam, wherein said focusing means focuses said sample

beam onto the sample so that the focused beam has a multitude of polarization states, wherein said polarization states are functions of an angle ϕ to a reference plane normal to a sample surface.

21. The apparatus of claim 20, wherein said focusing means focuses said polarized beam along different planes of incidence onto the sample, said planes being at different angles ϕ to the reference plane.

22. The apparatus of claim 20, said splitting means including a totally reflecting mirror placed less than completely across said beam.

23. The apparatus of claim 20, said splitting means deflecting a portion of said radiation in the beam from the source into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

24. The apparatus of claim 20, further comprising a detector detecting the reference beam to provide a reference spectrum, wherein said deriving means includes means for comparing said polarimetric spectrum and said reference spectrum to derive the film thickness and refractive index information.

25. The apparatus of claim 24, said radiation beam and said polarimetric and reference spectra including multiple wavelengths ranging from about 190 nm to about 830 nm.

26. The apparatus of claim 20, wherein said splitting means includes a polarizing beam splitter.

27. The apparatus of claim 20, wherein said splitting means includes a beam divider, said apparatus further including a polarizer.

28. The apparatus of claim 27, said polarizer being in an optical path to the focusing means and forms a part of the analyzing and dispersing means.

29. The apparatus of claim 27, said polarizer being in an optical path to the focusing means, said dispersing and analyzing means including an analyzer in an optical path from the collecting means.

30. The apparatus of claim 19, said analyzing and dispersing means including an analyzer, said apparatus further comprising a polarizer passing a beam of broadband radiation to form said polarizer sample beam, wherein during the focusing by the focusing means and analyzing by the analyzing and dispersing means, the polarizer and analyzer do not rotate.

31. The apparatus of claim 19, wherein said focusing means and said collecting means include a common objective that focuses the sample beam onto and collects radiation modified by the sample.

32. The apparatus of claim 19, further comprising a flip-in polarizer and means for moving the polarizer into and out of a path of the beam of broadband radiation from a radiation source to provide the sample beam that is polarized or unpolarized.

33. The apparatus of claim 32, wherein said polarizer polarizes the beam originating from the source and analyses the radiation modified by the sample and collected by the collecting means.

34. The apparatus of claim 19, further comprising a source of radiation, wherein said focusing means focuses radiation from the source onto the sample, said sample having one or more axes of birefringence, said apparatus further including

at least one aperture aligned with one of said axes, said aperture being in an optical path between the source and the analyzing and dispersing means.

35. The apparatus of claim 34, wherein said at least one aperture is centered about said one of the axes.

36. The apparatus of claim 34, further comprising means for selecting one of at least two apertures to be aligned with one of the axes.

37. The apparatus of claim 36, wherein said selecting means causes each of two different apertures to be aligned with a corresponding one of the axes, so that the polarimetric spectra obtained when the two apertures are aligned consecutively with their corresponding axes yields information on birefringence of the sample.

38. The apparatus of claim 37, wherein said selecting means includes a wheel with at least two apertures therein.

39. The apparatus of claim 38, wherein said wheel includes a polarizer in each of the at least two apertures.

40. The apparatus of claim 38, wherein two of said at least two apertures have shapes substantially in the shape of a circle with one quadrant blocked.

41. The apparatus of claim 19, further comprising a source of radiation, wherein said focusing means focuses radiation from the source onto the sample, said sample having one or more axes of birefringence, said apparatus further including means for rotating a linear polarizer in an optical path of the sample beam for detecting said axes.

42. The apparatus of claim 19, said broadband radiation including multiple wavelengths ranging from about 190 nm to about 830 nm.

43. The apparatus of claim 19, wherein said analyzing means analyzes the radiation modified by the sample with respect to a predetermined and fixed polarization plane.

44. The apparatus of claim 19, further comprising a phase retarder in an optical path between the collecting means and the analyzing and dispersing means, said retarder altering phase of the modified radiation collected from the sample prior to analyzing and dispersing it.

45. The apparatus of claim 44, wherein said retarder retards said phase of the modified and collected radiation by about $\pi/4$.

46. The apparatus of claim 19, said focusing means or said collecting means including a mirror having a coating that introduces a total change in phase of radiation reflected by it by the focusing means and collecting means of about $\pi/2$.

47. A method for obtaining complex refractive index and thickness information of one or more layers of a sample, said method comprising:

focusing a polarized first sample beam of broadband radiation onto the one or more layers, said beam having a multitude of polarization states;

collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

analyzing and dispersing the radiation modified and collected from the sample to provide a polarimetric spectrum;

focusing a polarized second beam of radiation at said one or more layers in a direction at an oblique angle to the one or more layers;

obtaining measurements of changes in polarization state in amplitude and phase of the radiation that has been modified by the one or more layers and that originates from second beam; and

determining complex refractive index and thickness information of said one or more layers from said measurements and the polarimetric spectrum.

48. The method of claim 47, wherein said first and second beams of radiation are focused to substantially the same area of said one or more layers.

49. The method of claim 47, wherein said first and second beams of radiation are focused to the one or more layers substantially simultaneously, and said collecting, analyzing and obtaining are performed substantially simultaneously.

50. The method of claim 47, further comprising splitting a beam of broadband radiation into said first beam and a reference beam; wherein said first beam focusing focuses said first beam onto the one or more layers.

51. The method of claim 50, further comprising detecting the reference beam to provide a reference spectrum; and wherein said determining includes comparing said polarimetric spectrum and said reference spectrum.

52. The method of claim 50, said splitting including directing the beam of broadband radiation to a mirror placed less than completely across said radiation beam.

53. The method of claim 50, said splitting including deflecting a portion of said beam of broadband radiation into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

54. The method of claim 47, further comprising polarizing a beam of broadband radiation to provide a polarized beam, wherein said focusing focuses such polarized beam such that the first polarized sample beam having a multitude of polarization states is focused onto the sample.

55. The method of claim 54, wherein said focusing focuses said polarized beam along different planes of incidence onto the sample.

56. The method of claim 47, wherein said first beam focusing and collecting employ a common objective.

57. The method of claim 47, said polarimetric spectrum including multiple wavelengths ranging from about 190 nm to about 830 nm.

58. The method of claim 47, wherein said analyzing and dispersing analyzes the radiation modified by the sample with respect to a predetermined and fixed polarization plane.

59. The method of claim 47, wherein the second beam focusing focuses a polarized second laser beam at said one or more layers, said obtaining obtains measurements of changes in polarization state caused by the one or more layers at the wavelength of the laser, and said determining determines the refractive indices of the one or more layers over said polarimetric spectrum.

60. The method of claim 47, wherein the second beam focusing focuses a polarized second beam of broadband radiation at said one or more layers, said obtaining obtains measurements of changes in polarization state caused by the one or more layers over a spectrum of the second beam, and said determining determines

the refractive indices of the one or more layers over a combined spectrum of the first and second beams.

61. The method of claim 60, said combined spectrum including multiple wavelengths ranging from about 190 nm to about 830 nm.

62. The method of claim 47, further comprising altering phase of the radiation modified by and collected from the sample prior to analyzing and dispersing it.

63. The method of claim 62, wherein said altering retards said phase of the modified and collected radiation by about $\pi/4$.

64. An apparatus for obtaining complex refractive index and thickness information of one or more layers of a sample, said apparatus comprising:

means for focusing a first polarized sample beam of broadband radiation to the one or more layers, and a second sample beam of polarized radiation at said one or more layers in a direction at an oblique angle to the one or more layers;

means for collecting radiation that originates from the first beam and that is modified by the one or more layers of the sample;

means for analyzing and dispersing the radiation modified and collected from the sample to provide a polarimetric spectrum;

an ellipsometer obtaining measurements of changes in polarization state in amplitude and phase of the modified radiation from the one or more layers originating from second beam; and

means for deriving the complex refractive index and thickness information of said one or more layers from the measurements of the ellipsometer and the polarimetric spectrum.

65. The apparatus of claim 64, wherein said focusing means focuses the first and second beams of radiation to substantially the same area of said one or more layers.

66. The apparatus of claim 64, wherein said analyzing means includes a spectrometer.

67. The apparatus of claim 64, wherein said focusing means focuses the first and second beams of radiation to the one or more layers substantially simultaneously, and said collecting and analyzing means and the ellipsometer perform their respective functions substantially simultaneously.

68. The apparatus of claim 64, further comprising:

a radiation source providing a beam of broadband radiation; and

means for splitting said beam of broadband radiation into said polarized first beam and a reference beam, wherein said focusing means focuses said first beam onto the one or more layers of the sample so that the focused beam has a multitude of polarization states.

69. The apparatus of claim 68, wherein said splitting means splits said beam from the source into a polarized sample beam and a polarized reference beam.

70. The apparatus of claim 69, said splitting means including a totally reflecting mirror placed less than completely across said beam.

71. The apparatus of claim 69, said splitting means deflecting a portion of said radiation in the beam from the source into a sample beam, the undeflected portion of the radiation defining a reference radiation beam.

72. The apparatus of claim 69, wherein said splitting means includes a polarizing beam splitter.

73. The apparatus of claim 69, wherein said splitting means includes a beam divider, said apparatus further including a polarizer.

74. The apparatus of claim 73, said polarizer being in an optical path to the focusing means and forms a part of the analyzing and dispersing means.

75. The apparatus of claim 73, said polarizer being in an optical path to the focusing means, said analyzing and dispersing means including an analyzer in an optical path from the collecting means.

76. The apparatus of claim 64, further comprising a detector detecting the reference beam to provide a reference spectrum, wherein said deriving means includes means for comparing said polarimetric spectrum and said reference spectrum.

77. The apparatus of claim 76, said polarimetric and reference spectra including multiple wavelengths ranging from about 190 nm to about 830 nm.

78. The apparatus of claim 64, said analyzing and dispersing means including an analyzer, said apparatus further comprising a polarizer polarizing a beam of broadband radiation to generate the first polarized sample beam, wherein said analyzer and the polarizer do not rotate when radiation from the first and second beams is modified by the sample and collected, dispersed, analyzed and measured.

79. The apparatus of claim 64, wherein said focusing means focuses said polarized beam along different planes of incidence onto the sample.

80. The apparatus of claim 64, wherein said focusing means and said collecting means include a common objective that focuses the first beam onto and collects radiation modified by the one or more layers at the surface of the sample.

81. The apparatus of claim 64, further comprising a flip-in polarizer and means for moving the polarizer into and out of a path of a beam of broadband radiation from a radiation source to provide the first sample beam that is focused by the focusing means.

82. The apparatus of claim 81, wherein said polarizer polarizes the beam originating from the source to provide the first sample beam and analyses the radiation that is modified by the sample and collected by the collecting means and that originates from the first beam.

83. The apparatus of claim 64, said broadband radiation of the first and second beams including multiple wavelengths ranging from about 190 nm to about 830 nm.

84. The apparatus of claim 64, wherein said analyzing and dispersing means analyzes the radiation modified by the surface of the sample and from the first sample beam with respect to a predetermined and fixed polarization plane.

85. The apparatus of claim 64, wherein said second beam is a laser beam whose wavelength is in the polarimetric spectrum, wherein the ellipsometer is a single wavelength ellipsometer that obtains measurements of changes in polarization state caused by the one or more layers at the wavelength of the laser, and said deriving means derives the thickness information and refractive indices over said polarimetric spectrum.

86. The apparatus of claim 64, said second beam having wavelengths in a broadband, wherein the ellipsometer is a spectroscopic ellipsometer that obtains measurements of changes in polarization state caused by the one or more layers over the spectrum of the second beam, and said determining determines the refractive indices of the one or more layers over a combined spectrum of the first and second beams.

87. The method of claim 86, said combined spectrum including multiple wavelengths ranging from about 190 nm to about 830 nm.

88. The apparatus of claim 64, said focusing means or said collecting means including a mirror having a coating that introduces a total change in phase of radiation reflected by it by the focusing means and collecting means of about $\pi/2$.